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Batracobdella cryptobranchii n. sp., parasitic on Ozark Hellbenders, Cryptobranchus alleganiensis bishopi, is found in the North Fork of the White River, Ozark County, in Missouri. B. cryptobranchii reaches a length of 17 mm; dorsum is smooth; color pattern or metameric markings are absent. The anus opens dorsally with two postanal annuli. Caudal sucker is circular, directed ventrally, and is distinct from the body on a very short pedicel. Gonopores are separated by two annuli.

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A NEW SPECIES OF LEECH, *BATRACOBDELLA CRYPTOBRANCHII* N. SP. (ANNELIDA: HIRUDINEA), PARASITIC ON THE OZARK HELLBENDER

GUY M. JOHNSON and DONALD J. KLEMM

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A NEW SPECIES OF LEECH, *BATRACOBDELLA CRYPTOBRANCHII* N. SP. (ANNELIDA: HIRUDINEA), PARASITIC ON THE OZARK HELLBENDER[1]

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JOHNSON, G. M. & KLEMM, D. J. 1977. A new species of leech, *Batracobdella cryptobranchii* n. sp. (Annelida: Hirudinea), parasitic on the Ozark hellbender. *Trans. Amer. Micros. Soc.*, 96: 327–331. *Batracobdella cryptobranchii* n. sp., parasitic on Ozark hellbenders, *Cryptobranchus alleganiensis bishopi*, is found in the North Fork of the White River, Ozark County, in Missouri. *B. cryptobranchii* reaches a length of 17 mm; dorsum is smooth; color pattern or metameric markings are absent. The anus opens dorsally with two postanal annuli. Caudal sucker is circular, directed ventrally, and is distinct from the body on a very short pedicel. Gonopores are separated by two annuli.

A small rhynchobdellid leech, thought to be a new species of *Batracobdella*, was first noted by Dundee & Dundee (1965) on Ozark hellbenders, *Cryptobranchus alleganiensis bishopi* Grobman, collected from Spring River in Arkansas. During an ecological study of this same subspecies of hellbender from the North Fork of the White River in Missouri, leeches were found abundantly attached to these hosts (Nickerson & Mays, 1973). Since these two rivers are in the same drainage system, the leeches are thought to be similar. On 24 September 1972, a survey of the relative positions of the leeches on the hellbender from the White River was undertaken, and a number of specimens were collected and preserved for further taxonomic study. This paper is based on these specimens.

MATERIALS AND METHODS

Leeches were removed from living hellbenders shortly after capture in riffles at the collecting site in the North Fork of the White River, Ozark County, Missouri, in September 1972. For a detailed discussion of the collecting site and collecting methods see Nickerson & Mays (1973). Some leeches were observed alive; others were preserved for dissection and for microscopic study. Specimens to be preserved were first anesthetized by adding 70% ethanol slowly to a small amount of water containing the leeches until they no longer responded to stimulation. They were then fixed overnight in 10% formalin and stored in 70% alcohol. Four specimens were dissected to determine the arrangement of the internal organs; two were embedded in paraffin for sectioning, and one (whole mount) was stained in Borax Carmine and cleared in methyl salicylate. Paraffin embedded specimens were sectioned at 8 μm, and a complete set of serial cross-

[1] We wish to thank Dr. Max A. Nickerson, Milwaukee Public Museum, for allowing us to name and describe the new species of leech and Dr. Allen M. Young, Milwaukee Public Museum, for valuable assistance during the course of this study. Appreciation is due Dr. Roy T. Sawyer, University of California, Berkeley, who reviewed an early draft of the manuscript and Dr. Marvin C. Meyer, University of Maine, Orono for valuable suggestions during its revision. Special thanks are due John L. Tottenham for his drawing of the lateral view of the caudal sucker.

sections and longitudinal sections was made. Sections were stained in Cason's modification of Mallory-Heidenhain stain and mounted in Permount. All drawings were made with a Wild M-5 microscope with a drawing tube attachment.

Systematic Account

Batracobdella cryptobranchii n. sp.
(Figs. 1–4)

Diagnosis: Size medium, up to 17 mm long at rest, moderately flattened, typically ovate-lanceolate; proboscis pore in sucker cavity of anterior sucker; eyes one pair, simple, close together or touching, but not coalesced, on somite III; complete somites triannulate; dorsal surface smooth; posterior sucker well developed, set off on short pedicel, directed ventrally; salivary glands diffuse; esophageal glands, one pair; gastric caeca seven pairs, lobed, first pair short when filled with blood, the last pair reflexed posteriorly in engorged specimens; testes six pairs, intersegmentally arranged, in somites XIII/XIV through XVIII/XIX; male and female gonopores at XI/XII and XIIa_2/a_3, respectively; intestinal caeca four pairs. Texture soft but not gelatinous; color variable, usually reddish-brown in engorged specimens due to blood in crop; no color pattern on dorsum; body translucent to slightly opaque.

Type locality: North Fork of the White River, Ozark County, Missouri, between Blair's Ford and Althea Spring.

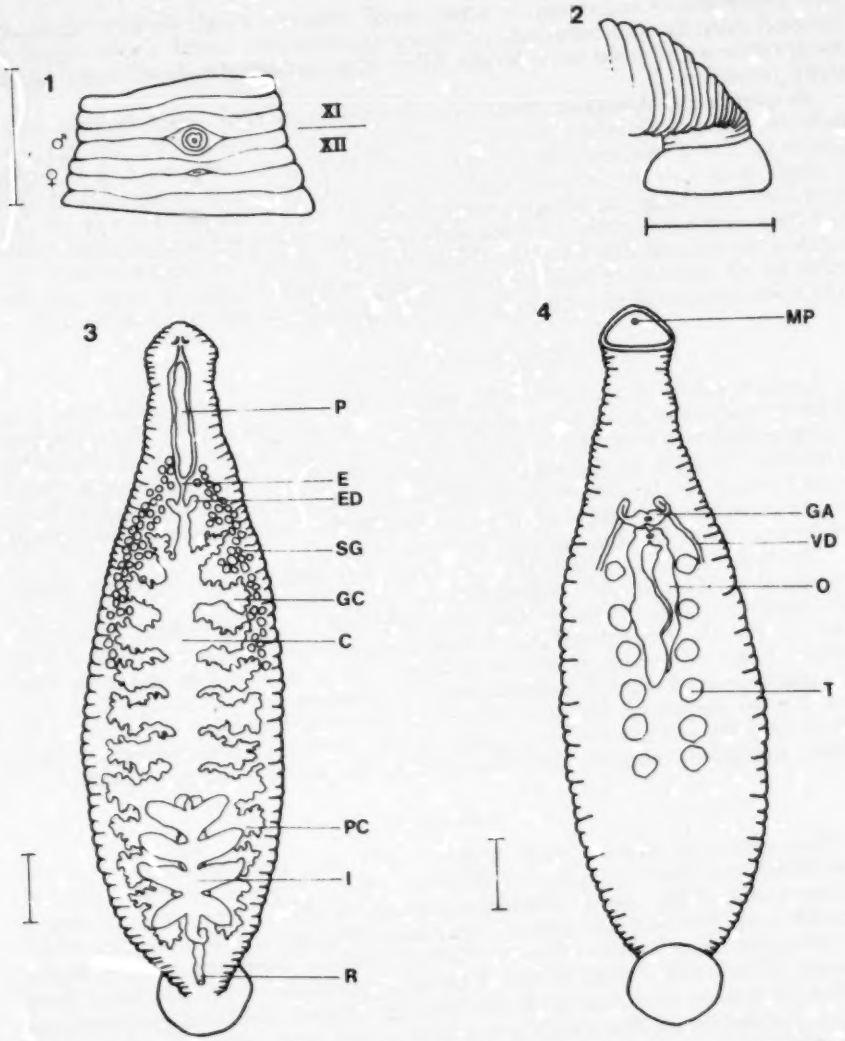
Description of Holotype

External anatomy (based on holotype, USNM No. 54365). Length, 10 mm; width of oral sucker, 1.3 mm; maximum width, 3 mm; width of caudal sucker, 1.4 mm; ratio of length to width, 3.3:1. Shape in normal resting state ovate-lanceolate; oral sucker small, oval, slightly wider than neck; eyes one pair on somite III, simple, slightly separated; oral sucker with moderately thickened rim; oral pore located within anterior sucker cavity; no clitellum distinguishable. Male and female genital pores in furrows separated by two annuli; male pore larger, opening at XI/XII, female pore opening at XIIa_2/a_3 (Fig. 1). The anus opens dorsally at XXVI/XXVII with two postanal annuli. The caudal sucker is circular, well developed, distinct from the body, with a very short pedicel (Fig. 2), ca. ⅛–½ maximum width of body, directed ventrally. Dorsal surface smooth. Complete somites are triannulate ($a_1a_2a_3$); total number of complete somites, 20 (V–XXIV); total number of annuli, 72.

Color of preserved specimens. Dorsum cream to golden, longitudinal and circular muscle bundles visible through cuticle and epidermis. There is no evidence of any regular pattern of metameric markings (prominences, papillae, white patches, or colored dots) on dorsum; ventral surface pale and translucent.

Internal anatomy. The internal anatomy was determined from dissections of four specimens of approximately the same size as the holotype, from serial cross-sections and longitudinal sections, and from a preserved specimen stained in Borax Carmine and cleared in methyl salicylate.

Digestive system (Fig. 3). Mouth pore within anterior sucker, somite III. Proboscis muscular, extending posteriorly to somite X. Leading from base of proboscis is the esophagus. Salivary glands diffuse, in somites IX to XVI. Two esophageal diverticula arise in somite X and reflex two annuli cephalad. Esophagus joins crop in somite XIII. Seven pairs of lobed gastric caeca, extend laterally from stomach, the first pair short in somite XIII, extending anteriorly into somite XII, the last pair elongate and directed posteriorly to somite XXIV.



FIGS. 1–4. *Batracobdella cryptobranchii* n. sp. Fig. 1. Region of gonopores, ventral view. Fig. 2. Caudal sucker, lateral view. Fig. 3. Digestive system, dorsal view. Fig. 4. Reproductive system, ventral view. Abbreviations: C, crop; E, esophagus; ED, esophageal diverticulum; GA, genital atrium; GC, gastric caecum; I, intestine; MP, mouthpore; O, ovisac; P, proboscis; PC, postcaecum; R, rectum; SG, salivary gland; T, testisac; VD, vas deferens. Scale ca. 1 mm.

Intestine arises from the posterior of the stomach, with four pairs of lateral diverticula, one pair in each of somite XX through somite XXIII. Intestine tapering into narrow rectum which opens dorsally at anus in furrow XXVI/XXVII.

Reproductive system (Fig. 4). Testes six pairs, intersegmental in somites XIII/XIV through XVIII/XIX; vasa efferentia not seen, except where they join

vasa deferentia. Genital atrium small, atrial cornua conical, slightly expanded, directed dorsally and anteriorly. Ovisacs are elongate, membranous tubes; in the specimens examined were usually filled with partially developed eggs; vagina short, muscular.

Paratypes and variation. More than 50 individuals of *B. cryptobranchii* were collected from hellbenders during the initial phase of this study. The range in length for the specimens collected was from 5 to 17 mm. All specimens had only a single pair of eyes, usually slightly separated, but in some individuals the eyes were touching. In all specimens examined the dorsal surface was smooth, and there was no evidence of metameric markings (prominences, papillae, white patches, or colored dots) on the dorsum of any of the leeches collected. The color in all specimens was uniform, either reddish brown in engorged live specimens because of blood in crop or cream to golden in preserved individuals.

Ecological Observations

Large numbers of *Batracobdella cryptobranchii* were found on the feet, axes of limbs, under the lower jaw, and around the spiracles of most of the specimens of *Cryptobranchus alleganiensis bishopi* collected. Leeches were frequently found in clusters of from six to eight individuals. These clusters were often found around lesions in the skin of the host, the lesions sometimes amounting to large sores, especially on the feet and toes. It is not known whether the leeches caused the lesions or merely attached near an open wound.

The number of *B. cryptobranchii* found on individual hellbenders varied considerably. Out of 53 hellbenders surveyed, the number of leeches per individual varied from 0 to 48. Only two hellbenders were free from infestation. None of the *B. cryptobranchii* collected were carrying young on their ventral surface; however, leeches of widely differing size were found on the same host. It is not known whether *B. cryptobranchii* remain permanently attached to their host, but no leeches of this type were observed on the rocks in the river, or on any of the other animals observed: map turtles, *Graptemys geographica*; snapping turtles, *Chelydra serpentina*; and fish (Nickerson, personal communication).

Discussion

Four species of *Batracobdella* Viguier, 1879 have previously been reported from North America: *B. paludosa* (Carena, 1824), *B. picta* (Verrill, 1872), *B. phalera* (Graf, 1899), and *B. michiganensis* Sawyer, 1972. *Batracobdella cryptobranchii* n. sp. has only one pair of eyes, thus differing from *B. paludosa*, which has two pairs. *B. paludosa* is found in Eurasia, and its occurrence in Nova Scotia, Canada (Pawlowski, 1948) is based on one specimen which has never been confirmed there or elsewhere in North America. Unless additional specimens are found, the validity of this identification and record must remain in some doubt. *B. cryptobranchii* can be distinguished from *B. michiganensis*, *B. phalera*, and *B. picta*, the only valid members of the genus reported from North America (Klemm, 1972b, 1977; Sawyer, 1972), by the lack of metameric markings on the dorsum, and by the absence of white patches on the dorsum in the eye, neck, genital, and anal regions. *Batracobdella cryptobranchii* is similar to *B. picta* in that the dorsal surface is smooth; however, *B. picta* has variable white patches around eyes and neck region, a middorsal stripe, and four series (rows) of yellowish dots (sensillae) on the dorsum. *Batracobdella cryptobranchii* differs from *B. phalera* which has three rows of dark tipped papillae and white patches in eye, neck, genital, and anal regions and from *B. michiganensis* which has five

rows of white prominences surrounded by yellowish dots and white patches in eye, neck, genital, and anal regions.

The only known host of *B. cryptobranchii* is the Ozark hellbender, while the hosts of *B. picta* are a variety of amphibians (Klemm, 1972a, 1975; Sawyer, 1972), and those of *B. phalera* are fish (Klemm, 1972a, 1975; Sawyer, 1972). No host is known for *B. michiganensis*, but either amphibian or fish hosts are suspected.

Soós (1967, 1969) lists 16 species in the genus *Batracobdella* but erroneously reassigned *B. phalera* and *B. picta* to the genus *Placobdella* because of the lack of adequate taxonomic descriptions. Sawyer (1972) indicated that their systematic positions are still unsettled today.

Batracobdella cryptobranchii n. sp. can be distinguished from *B. cancricola*, *B. dubia*, *B. hardingi*, *B. nuda*, *B. quadrata*, and *B. singularis* by having the male and female gonopores separated by two annuli, whereas the others have one to one and a half. It differs from *B. mahabiri*, which has compact salivary glands and shows subdivision of all three annuli in complete somites; *B. cryptobranchii* has diffuse salivary glands and shows no subdivision of annuli. *B. cryptobranchii* has only one pair of eyes and two postanal annuli; *B. reticulata* also has two postanal annuli, but has two pairs of eyes. *B. algira*, *B. amnicola*, *B. gemmata*, *B. lobata*, *B. magnidiscus*, and *B. tricarinata* all have only one postanal annulus, and *B. cryptobranchii* differs from *B. nilotica* by the absence of prominent rows of papillae.

The holotype (USNM No. 54365) and 10 paratypes (USNM No. 54366) are deposited in the U.S. National Museum. The other paratypes are deposited in the Milwaukee Public Museum, Catalog numbers 2675, 2676, and 2677.

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